

DIY MINI-AQUAPONICS SYSTEM

“It’s all about Growing, Making and Eating Green”



This is the first mini-aquaponic systems that I've created. It was created after watching a YouTube video by Vinil Ratnakaran of Bangalore India.

NOTE: As you may realize I'm offering these DIY plans for free as a way of sharing this knowledge to help as many people as I can to learn that they can be GEREEN no matter where they live and in virtually any situation.

All I ask is that if you do build a system from these plans that you sent me pictures of your build or a video so I can add it to my site. I'll include a link to your site as the builder if you wish which will help to promote both of us. I also asked that you'd share my site with others as the opportunity arises.

Thank you in advance.

Rene Bastarache
(the green guy)

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What is a Mini Aquaponic System?

Aquaponics is a form of hydroponics that requires live fish to be included in the system as a way of using their excretions for fertilizing the crops that you're growing in it rather than adding any type of outside fertilizer or even nutrients to the water.

It is a completely closed system that requires nothing else to grow with the exception of fish food.

- The fish eat their food and create fertilized water.
- Bacteria breaks down the "fish stuff" to create nitrates.
- The nitrates are then circulated to the top portion of the system.
- It's distributed to the plants up there as fertilizer.
- The plants in turn grow happy and create oxygen.
- And all this drains back to the fish to start all over again.
- It is a completely symbiotic balance of "man-made" nature.

In a commercial aquaponic system farmers will grow their crops and often-times grow types of fish that they can sell at market such as tilapia, freshwater cod or even catfish.

A mini-aquaponic system works in the same manner however is designed on a much smaller scale so you can build one and use it virtually anywhere. I've placed mine on coffee tables and even on the floor in front of the living room window as a way to get more light and spruce up the room.

You'll find them to work great for growing herbs for cooking and other smaller crops due to their size.

Since it's so small, rather than using tilapia or catfish we've chosen to use goldfish as they can live in virtually any type of water, temperature and create lots of excrement or as my wife calls it; "caca".

Isn't this whole concept sounding appetizing now?

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LIST OF MATERIALS

- One 5-gallon water bottle (the types they use in water coolers)
- Something to cut it with (I used a jigsaw)
- Masking tape - I like to use the wide one approximately 2"
- Pointed tip erasable marker
- Tape measure
- Sandpaper
- Spray paint - black matte or semi-gloss finish – I used Rustoleum 2x
- Dimensions of PVC required:
 - 3/4" PVC pipe - I purchased one 10' length and cut it into:
 - three 22" pieces for the legs
 - Six 3/4" end-caps.
 - Bell-siphon mechanism
 - 1/2" PVC pipe for the Bell siphon drain about 2 feet will do it.
 - Two 1/2" PVC elbows to direct the water below the Bell siphon.
 - One-foot long piece of 2" PVC pipe for "media straining" guard.
- 3/4" Rubber grommet to connect the bell-siphon pipe to the bottom of the top. You'll need to insert a 1/2 inch PVC pipe through the bottle. The pipe will need a bit larger grommet to fit and the grommet will need a slightly larger drill to fit.



- Hole Drill: I used a 1" hole drill. Try a practice cut in a worthless piece of plastic first as this will be a tight seal. I sanded the edges a bit to give it a little more play. This is to create the hole in the bottle for the bell-siphon pipe
- Hot glue or silicone
- PVC pipe glue
- PVC pipe cutter or saw
- Submersible water pump
- Black plastic tubing for pump – 1/2"

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1/2" INSIDE DIAMETER

- Electronic timer
- Hydroton pebbles



- Water
- Plants – whatever you want to grow
- Fish
- Aquarium rocks
- Jigsaw
- Snips / cutter to cut ends of zip-ties

INSTRUCTIONS

Step One: Cutting the Bottle

I spent many hours searching and making phone calls trying to find free empty bottles or extremely low cost ones to make my projects and finally found that the best place to get them was at Walmart for approximately \$7.00 each.

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I did find a bottle redemption center that gave me my five initial bottles however they were quite scratched up and several years old.

The picture above shows where I cut the bottle in two. Unfortunately it seems like each different company has their own particular shape of bottle so there is no exact location to tell you where to cut.

In most of my bottles I usually cut approximately 1/3 off the top. This way the top inverted will give me enough room for planting and I'll have at least 2 1/2 or more gallons for the fish to swim around below.

I used an electric jig saw to cut these. Be careful when using a jig saw because often times the guide that slide on the bottle will actually scratch the bottle as well. To eliminate this you may want to put a wide piece of masking tape around where you're going to cut. Mark the tape with a marker so you know where your cutting and once you finish you can remove the tape which is protecting the plastic while you're cutting.

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Step Two: Drilling The Hole For The Bell Siphon in the Top Segment

NOTE: If you don't want to use a bell-siphon in this system, it's not necessary. You can just create a drain to flush the water below however you'll still need to create a strainer so the water drains through.

You can take a piece of plastic and drill holes in it or even the top of an aerosol can. Drill holes in it and glue it over the hole using a food safe silicon.



I used a 4" PVC pipe end cap, drilled the hole, inserted the grommet and pipe and siliconed it to the bottom of the top segment as the drain. (pic on left above) The bell-siphon could then rest on top of it. (pic below)

I would have preferred to make the drain in the bottle cap (above right) rather than the way I did but these initial bottles did not have any caps so I made my own seals.



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Do not glue the siphon so it can be removed and cleaned in the future if needed.

CAUTION: I used a 1" bit to drill the hole for the grommet. This rig will often times destroy the plastic when it hits.



What I do to prevent this is once the inner drill had slightly penetrated the plastic I then set the drill in reverse and drill the 1" hole in "reverse".

The teeth are less abrasive this way and will make a cleaner cut without destroying your plastic. This is also a great way to drill holes in styrofoam or other soft, non-wood products as well.

Step Three: Painting The Bottle and Frame



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In the above picture you can see how I placed masking tape around the bottle leaving about a ¼” to ½” lip around the top uncovered and a portion of the bottom uncovered as well. I did this so I could then spray-paint the bottle without getting paint on the middle portion so you can watch the fish while they're swimming.

Be careful when painting the top rim that you don't paint inside the bottle as the paint would then come in contact with the fish.

It's also important to use a masking tape that's intended for painting as it's not as sticky as most other masking tapes and will leave less residue remaining on your bottle when you remove it.

I also took the three legs with the end caps already inserted on them and painted all three legs black before putting the system together.

Step Four: Assembling the Legs to the Bottle.

I assembled the legs to the bottle using zip ties. I used a quarter-inch drill to pre-drill the holes in the PVC legs as well as a whole approximately 1/2 inch from the top of the bottom part of the bottle.

My decision for a half-inch hole was simply because that's the size I would need for my zip tied to fit through the hole easily. Be sure to only drill a hole in the top part of the base of the bottle because the remainder of it will be filled with water.

When measuring where to place the holes; I just placed the PVC alongside the base of the bottle so that the base could sit flat on the table top being level with the bottom of the legs. In other words both the footings of the legs and the base of the bottle should all be touching your tabletop surface when you connect it.

Once you have it all level, drill your holes at the height required to be able to connect them.

The top part of the basin can be simply connected at the top of the 22 inch legs once again with zip ties; drilling one hole in the top of the basin and a hole through the PVC pipe so the zip tie can go through both holes and

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connect tightly. Be careful not to connect too tightly so you don't crack the water bottle.

There's no specific reason for the height between the top and bottom bottle. I just made it tall enough so I could reach into the bottom bottle to easily adjust the water pump and work with the fish if needed. You can make the system higher or lower as you desire. The strength of your water pump may have something to do with your height decision as well.

Step Five: Assembling the Bell Siphon and Drainage Pipe

Here's the free pdf link I used to create my bell-siphons while it's still available online: www.ctahr.hawaii.edu/oc/freepubs/pdf/BIO-10.pdf

You can also find many additional webpages, free information and videos on building your own bell-siphon on the internet.



Almost looks like explosives but they "are" bell-siphons!!! 😊

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Rather than showing you how to make the bell-siphons which would be an entire course in itself I've included a PDF that you can use which will help you to design your own.



The bell-siphon goes over the out-take pipe and sits freely on the rubber gasket. The strainer pipe then goes over that. Be sure to hold it down when filling the system with media so you don't get any inside the pipe or underneath it.

Make an outside strainer to place around the bell-siphon as in the top left picture that sits on the bottom of the container and extends above the bell and slightly above the media as well. This will eliminate media from getting into your siphon and clogging up the entire process. You can cut slits in it as in the picture or simply drill holes in it.

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Be sure to practice and make sure it works well before adding your media.

If you have any problems with it not working properly please refer to the PDF on how to build the siphons. This PDF also has a very good troubleshooting section. I've found it quite helpful myself when problems arose.

Step Six: Washing Everything and Testing Your System

Now it's time to wash everything really well, strain all the dust out of your media and add your submersible water pump.

Initially when I began washing out my media (the Hydroton clay pebbles) I did it in a large tote that I placed in the bathtub. Keep in mind that the Hydroton has a considerable amount of dust within the bag. When you pour it into your tote, chances are you'll get your entire bathroom covered in brown clay dust. If you're able to do this outside it would be a plus for you and you won't have to sleep in the dog-house that night...

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I eventually found that a better way to clean out the media is simply to poke holes in the bottom of the bag for drainage and fill it up the bag with a hose letting the water continually drain out the bottom until it runs clear. Once again, doing it outside or in the tub are best...

If you allow too much of this clay dust to stay within your system it can easily clog up your submersible pumps.

Make sure you buy a pump that has enough height to be able to pump the water over your top bottle wall. 2" of head would do it for this system.



I purchased the 80GPH Submersible Water Pump Aquarium Fish Tank Powerhead Fountain Hydroponic – I got a two-for-one deal on Ebay for \$11.76

- Max Head: 2.2 ft MPN:
- Tank Capacity: 5 gal.

Use the larger of the two fittings as you see connected to the pump in the picture, connect it to your ½" tubing.

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The pump goes into the bottom of your water reservoir and the top of your hose goes into the top so it pours onto the media. You'll need to find a way to secure the top of the pipe so it's doesn't move when the water goes through it and you have a flooded home.

You can use zip-ties or an elbow of some sort to hook it to the side of the bottle. I heated the tube until it bent into a hook shape and connected it to a T-fitting.

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Step Seven: Connecting a Timer

You can use any type of timer you want and how often to cycle it will be a matter of trial and error for you. Each system is different depending on the amount of media, filling time, type of pump and how much moisture your plants need. Mine cycles on for 1.5 minutes every 45 minutes round the clock but I have another that goes every hour.

I had initially purchased two, \$4.00 manual timers from Walmart which although they work wonderfully, they're very limited in your choices for timing options. The minimum setting time was 30 min. I required only 2 minutes on and one hour off which I was not able to do with that type of a timer. That's why I went with the electronic timer below which many people seem to use for aquaponics.

Each timer will have instructions to set them up with the unit and you can always find YouTube videos online to help.



I used the “Timer Outlet, Nearpow Multifunctional Infinite Cycle Programmable Plug-in Digital Timer Switch With 3-prong Outlet for Appliances”

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It's \$13.99 on Amazon at the creation of these plans. Do a search and you'll find it.

Step Eight: The Finishing Touches

Now it's time to add fish, decorations, plants and an aerator if you need one...

I add the fish first for a week or so to build up the nitrates and give the plants a head-start. Although it takes about 2 months to get the nitrates effective; I'm just too impatient to wait that long...

Be sure to wash any aquarium decorations and if the rocks are not aquarium safe to make sure there's nothing in them that could hurt your fish like lime, salt or harsh minerals.

Step Nine: Take Pictures or a Video and Send Them to Me

1. I'd love to see how your set-up turned out. Drop me a line with your progress and end product at:
e-mail at: renebstarache@yahoo.com
2. Help me to grow by sharing my site with all your friends.
3. If you haven't done so please give me a thumbs up and leave a comment on my page so I know you're interested in building the system.
I do this for free so the thumbs up and comments really help me grow... Thanks!

Congratulations!!! [You Just Created Your Very Own Mini-Aquaponics System!](#)

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Rough Cost of Materials:

I kept receipts for most of my materials and I'll guesstimate for the rest of them. This is cost of materials to build and not the tools you may already have to build like saws and tape measures...

• One 5-gallon water - \$7.00 at Walmart	\$7.00
• Masking Tape	\$3.00
• Spray paint-black matte or semi-gloss finish	\$3.75
• One ¾" PVC pipe, 10' lengths	\$6.50
• One ½" PVC cheaper to get a full length	\$2.50
• Six ¾" end-caps	\$3.00
• Two ½" PVC elbows	\$1.00
• ½" Rubber seal / grommet	\$.75
• PVC pipe glue	\$5.00
• PVC pipe cutter or saw - Home Depot	\$14.00
• Submersible water pump	\$6.00
• Black plastic tubing for pump - ½"	\$2.00
• Electronic timer	\$13.00
• Hydroton (media) - \$32, enough for 3 systems	\$11.00
• Water free unless you buy it...	0
• Plants - \$3.00 each	\$6.00
• Fish	\$10.00
• Aquarium rocks	<u>\$5.98</u>
Total:	\$100.48

This system may seem expensive at first glance however keep in mind that this price also reflects the cost of:

- The fish
- Plants
- Aquarium rocks
- Electronic timer and
- Hydroton

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1. You may already have some of these on hand or have alternatives that you can use for each.
2. Some people will take fish from their own aquariums or other systems.
3. You may be growing your own plants and will save cost there.
4. You may want to use river rocks or some other media you have on hand.
5. You can also use river rocks rather than aquarium rocks for the bottom tank as well.
6. If you don't use a bell-siphon you'll have no need for an electronic timer.
7. You may already have a PVC pipe cutter or you can just use any saw that you may have which reduces it another \$14

These items alone costs approximately: \$59.98

That covers more than half the cost of the previously mentioned expenses leaving the cost of the entire system at:

Only \$40.

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- **SYSTEM #2**

DIY MIMI-AQUAPONICS, VERTICAL TOWER SYSTEM



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After making my initial system I wanted to find a way to be able to grow more plants using the same type of the system so I created this one.

I decided to make a Vertical Tower taking advantage of limited indoors space.

Differences between this system and system #1 above:

- The legs are made from 1" x 3" wood.
- I screwed the parts to the frame rather than zip tied for added strength (pre-drilled holes in bottle and wood)
- I used the tops of three bottles rather than just one. (Only the top one has a bell siphon and the other two simply have a drain. Otherwise you may flood your home if all siphons work separately of each other.)

You'll need a slightly stronger submersible pump to ensure you can pump water the additional height. Be sure to check how high your pump will send the water before you purchase one and build the height of your Vertical Tower accordingly.

Although you can make this one with a PVC frame as well: I felt it would be more stable using 1" x 3" pine strapping.

Since my bell-siphon was only in the top level, I needed to find another way to make sure the media was getting wet enough on the second and third levels. Without a bell-siphon there was no flooding to ensure equal wetting and the water was only draining in one small area.

What I did to solve this problem was connect a T-fitting below the plant bed drain connecting to two smaller pieces of pipe to extend it out a little bit further and then two elbows shooting the watered-down. This way the water was being separated in two areas rather than just one.

I also made sure that I planted my plants fairly close to the drainage areas to ensure they received the moisture they needed. If you're planting something that doesn't need as much moisture you can place them further away from the drain area.

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I also painted the wooden legs black of the system as the wood I was using had been around my workshop for quite a while and was not looking very good unpainted.

I hope you found these plans useful and enjoy creating your system as much as I did.

Best of Success,

Rene Bastarache, CI

<https://WhyAmIGreen.com>